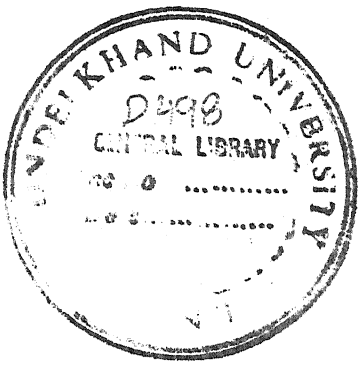
THE MANNHEIM PERITONITIS INDEX AND OTHER GRADING SYSTEMS IN THE EVALUATION OF PERITONEAL SEPSIS

THESIS

for

MASTER OF SURGERY

[GENERAL SURGERY]



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JHANSI (U.P.)

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CERTIFICATE

This is to certify that the present work entitled, "THE MANNHEIM BERITONITIS INDEX AND OTHER GRADING SYSTEMS IN THE EVALUATION OF PERITONEAL SEPSIS," has been carried out by Dr. Subodh Kumar Gupta under my constant supervision and guidance. The results and observations were checked and verified by me from time to time. The techniques embodied in this work were undertaken by the candidate himself.

This work fulfils the basic ordinances governing the submission of thesis laid down by Bundelkhand University.

Dated: 31.10.1996.

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CERTIFICATE

This is to certify that Dr. Subodh Kumar Gupta has worked on, "THE MANNHEIM PERITONITIS INDEX AND OTHER GRADING SYSTEMS IN THE EVALUATION OF PERITONEAL SEPSIS", under my guidance and supervision.

His results and observations have been checked and verified by me from time to time.

Dated : 31.10.1996

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ACKNOWLEDGEMENT

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I am thankful to all my patients, who were the backbone of this study.

Lastly, I wish to express my thanks to Mr. R.S. Vishwakarma, who took keen interest in typing this work and completed it within time.

Dated : 31.10.1996.

(SUBODH KUMAR GUPTA)

INTRODUCTION

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It is frequently said, and with some truth, that you cannot begin to investigate something until you can measure it. Thus there is no doubt, that the clinical study of sepsis has greatly improved after on the introduction of various methods to grade its severity.

Abdominal sepsis is a daunting challange requiring deft management because of a very high morbidity and mortality. To over come this problem early prognostic évaluation of abdominal sepsis is desirable to select high risk patients for aggressive therapeutic approach and to provide objective classification of the severity of disease.

Peritonitis is a disease which still causes much suffering and death despite the advances of medical science and good number of new antibiotics. So for the purpose of proper resource, allocation and to predict the outcome certain systems and scales have been used consisting of clinical and biochemical variables.

Most of these indices and scales were developed in advanced countries but their efficacy is yet to be tested in our setup in developing countries.

The severity of intra-abdominal infection and poor prognosis led to the development of a variety of therapies, like radical debridement, lavage system and open management. The indication for more aggressive procedures should probably be limited to severe form of peritonitis, but still there is no universally accepted objective method of catagorizing the degree of sepsis in such patients.

In this study, we have concentrated on various scoring systems (Mannheim Index, and Severity of Sepsis (SS), which can prognostically stratify these acutely ill patients of peritonitis by helping in their management and predicting the mortality to a certain extent.

Hence there is need to study the factors effecting the outcome of patients suffering from peritonitis because of any cause.

The present study deals with "The Mannheim peritonitis index" and "Severity of Sepsis" other grading systems score in the evaluation of peritoneal sepsis.

Presently, our setup is not so well equipped that we can adopt Mannheim peritonitis index and Severity of Sepsis score in toto, routinely instead we lay more stress on the cause of peritonitis and other associated diseases

in predicting the morbidity and mortality of Intra-Abdominal Sepsis patients.

The scoring index can be used to utilize optimaly the available hospital resources and compare the efficacy of intensive care in different hospitals or over a specific period in the same centre.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Peritonitis was recognised as a uniformly fatal condition more than 2,500 years ago. Even in present time, despite the use of antibiotics, blood transfusion and modern anaesthesia and several therapies, it still remains a life threatening disease.

In peritonitis the serosal mast cells release histamine serotonine and other permeability factors leading to increase in blood flow and permeability. This leads to exudation of protein rich fibrinogal containing plasma into the peritoneal fluid (Buckman et al 1979).

In representative autopsy finding at a German hospital, inflammation of peritoneal cavity was noted in 897 of 11,000 hospital admission in one year (8%). In 56% of cases peritonitis was the sole cause of mortality while in 37% cases it was a major cofactor of death (Wittmann DH 1987).

Since intraabdominal sepsis continues to carry a high mortality so grading of sepsis and subsequent clinical therapeutic trials are essential. Several systems have been introduced for grading of severity of Intra Abdominal Sepsis (Meaking et al 1984).

Intra-abdominal infection most commonly is secondary to perforation of a hollow viscus. In 567 consecutive patients operated on for peritonitis at the General Hospital,

Hambury Altona, spontaneous perforation accounted for 73% of cases and post operative perforation was seen in the remaining 27%. Perforation was found in stomach and duodenum in 30%, appendix in 22%, large bowel in 21% and the small bowel in 13% of cases. All other sources of infection represent less than 9% (DH Wittmann, JS Lolomon, 1987).

To this day, the criteria for classification of peritonitis have failed to yield a reliable prognostic index, mainly because the outcome of an abdominal infection depends upon the complex interaction of numerous factors. But on other hand these indices or scoring system have helped to evaluate the therapeutic strategies.

The predictive indices used today have reached a remarkable degree of perfection. The peritonitis index Altona (PIA II) and APACHE I and II and Grading the severity of sepsis and various other.

Baker (1974) introduced the injury severity score which represented a big advance in the study of different aspects of trauma.

Incidence of trauma as a cause of bacterial peritonitis has been reported from 1 - 25% (Dube Key 1940, Long et al 1970, Bhansali 1967, Budhraja et al 1973, Tripathi et al 1993). Traumatic perforation leading to peritonitis is more commnly

seen in males probably due to their outdoor working profession and is common between the ages of 20-50 years. Small Intestine is the most commonly involved site in traumatic perforations (Klke 1961).

Siegal et al (1979) also developed a system for classifying patients with sepsis by using a number of cardiovascular parameters not all of which are easily obtainable. Despite the value of this method something simpler is needed which could be applied at a district general hospital level and yet which could still be more sensitive than a simple 0-10 scale which has sometimes been used in such situations.

Linder and Wacha (1987)preposed Mannheim Peritonitis Index which is based on data from 1253 patients with peritonitis treated between 1963 and 1979. This Index was developed by discriminant analysis ofi 17 possible risk factors. Eight of these were of prognostic relevance and were entered into the current index with a weighting according to the predictive power. The information was collected during the first laparotomu, enabling immediate classification.

The original reports excluded patients with post operative peritonitis and appendicitis, but further investigation revealed that inclusion of these groups did not reduce the predictive value.

MANNHEIM PERITONITIS INDEX

Prognostic factors	Weightage
1. Age of $\geq$ 50 years	5
2. Female sex	5
3. Organ failure	7
4. Malignancy	4
5. Preoperative duration of peritonitis $\geq$ 24 hours	4
6. Origin of sepsis not colonic	4
7. Diffuse generalized peritonitis	6
8. Exudate	
- Clear	0
- Cloudy purulent	6
- Fecal	12

Organ failure will be considered as follows :

Organ	
Kidney	Creatinine level $\geq$ 177/mol/lit Urea level $\geq$ 167 mmol/lit Oliguria $<$ 20 ml/hr.
Lung	Po_2 $<$ 50 mmHg Pco_2 $\geq$ 50 mmHg
Shock (definition according to Shoemaker)	Hypodynamic or hyperdynamic
Intestinal obstruction (Only if profound)	Paralysis $\geq$ 24 hr or complete mechanical ileus

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Meaking et al (1984) have recommended the Acute Physiology Score (APS) of Knaus et al for estimation of risk in abdominal sepsis. Under umbrella of "Serious Intra Abdominal Infection" different diseases, processes and patients are being studied. They define a binomial classification incorporating both an anatomic and functional aproach to Intra Abdominal Infection. There are ten etiological classification factors of Intra Abdominal Infection combined with an Acute physiological Score (APS). It was anticipated that using this approach will provide a technique to evaluate patient group uniformly in which drug or technical approachs to the management of Intra Abdominal Infection are being studied.

A criticism of this scheme is that by dividing the available patients into many groups, will not be available in any other groups. But enough members for valid comparison and no classification or group has been assigned to fistulas.

Knaus et al (APACHE - Acute Physiology and Chronic Health Evaluation) : A Physiologically based Classification System (1981). For estimation of risk in abdominal sepsis proposed APS as a reliable predictor of outcome in large number of patients in the intensive care unit. However, APS has not been validated in patients outside of the intensive care unit. They then developed a simpler

modification of APS, namely the Acute Physiology and Chronic Health Evaluation (APACHE II).

The original APACHE system developed by Knaus et al (1981) provides weighings for 34 potential physiologic derangements, the sum of which yields an acute physiology score. The APS reflects the degree of derangement of all the body's seven major vital physiologic system, viz.

1. Neurologic
2. CVS
3. Respiratory
4. GIT
5. Renal
6. Metabolic
7. Haematologic

Like the Killip and Narris index for heart attack victims and GCS scale, it quantifies the body's physiologic response to acute crisis.

APACHE chooses the 0-4 weighting system to convert 33 physiologic measurements into a reproducible score as it simulates the clinical evaluation of critically ill patients. Depending upon the patient's medical history, the more abonrmal the measurement, the more severely ill is the patient. The decisions as to which physiologic measures to

include, where to divide into ranges, and what weight to assign to the ranges were made by a panel of experience ICU physicians. The panel of expert concluded that not every physiologic measurement was a range of weights from 0-4 and some physiologic parameters, no matter how deranged, they were assigned only 1-2 points.

Second, the sum of weights assigned to different physiologic abnormalities is an additive scale which can be treated as a single cardinal measurement.

When multiple measurements are available the assigned weight is determined by value farthest removed from normal that is lowest B.P. for shock or highest respiratory rate for patient in respiratory distress.

The second part of APACHE classification system is the chronic or preadmission health status. It is measured with a system of a patient types or categories : a) Good health, b) mild moderate limitation, c) serious limitations and; d) severe restriction of activity. After reviewing the patients medical record the patient is assigned to one of the four health types based on answer to 10 MCQs. Many of the items used in chronic health evaluation were derived from previous studies of health status such as health interview survey, the Rent Health Insurance study and the New York Health Association Index.

The four categories are designed to obtain a general assessment of patient's chronic health status six months prior to ICU admission. They are directly related to hospital survival with approximately a fourfold increase in probability of death for Type D patients when compared to Type A.

As such the APACHE system appears promising as a prognostic scale in randomized clinical trials or retrospective case control studies. Acutely ill patients could be prognostically straitified using APS or randomly assigned regardless of APS.

APACHE classifications are not entirely independent of therapy. Prompt medical actions might rapidly correct abnormal physiologic measures and can certainly stop their progression.

Surgical Infection Stratification System for IAI (Delinger et al, Arch Surgery 1985; 120:21-29)

187 patients treated for established IAI in 5 medical centres were studied using this system. This system combines an anatomic category with numerical acute estimate physiology score (APS) of deviation from normal, of 33 routine laboratory or physical findings. Overall mortality was 24% and rate of treatment 'success' with a single operation and single course of antibiotics was 48% (Delinger et al 1985).

Patients choosen for the study had proved intra-abdominal abscess or peritonitis originating from stomach or duodenum (Group 1), small bowel (Group 2), large bowel between caecum and rectum at the pelvic peritoneal reflection (Group 3), postoperative complications (Group 4), or the appendix (Group 5). Infections originating from primary disease in other anatomic locations, such as liver, biliary tract, pancreas, or genitourinary tract, were excluded.

In all patients, diagnosis was confirmed by laprotomy for treatment of peritonitis or dranage of intra-abdominal abscess, or by percutaneous drainage of intra-abdominal abscess. Perforated duodenal ulcers of duration less than 12 hours or with negative operative cultures were excluded.

APS was computed for each patient on day - 1. The APS records the degree of deviation from normal of 33 routinely measured laboratory tests of physical findings, using a scale from 0 to 4. A normal test or a test not obtained because it was not considered clinically relevant for the individual patient was scored 0. Four of the tests have maximum scores of less than 4. A perfect total APS is 0. The maximal possible abnormal score is 124. In practice, it is quite rare for any patient to score greater than 50.

Complete data were obtained for 187 patients from the five centers. The average age of the patients studied was 51 ± 19 years (range 15 to 90 years) with 102 males and 85 female patients. Forty-four (24%) of 187 patients died. When the variables were examined by independent statistical tests, patients who died were substantially older, had higher APSs, and were substantially more likely to be diabetic, malnourished, or in shock.

Almost half of the infections were of postoperative origin, while 57% arose due to spontaneous disease of or trauma to the GI tract between the gastroesophageal junction and the peritoneal reflection. Of the postoperative infections, 57 (71%) occurred following operations on the stomach or intestine between the gastroesophageal junction and the peritoneal reflection (group 1 through 3 and 5). There were no significant differences in mortality between the different anatomic groups ($p \not< 0.5$) with exception of the 0% mortality associated with infections deriving from appendicitis ($p < 0.005$).

The APSs on day 1 averaged 14 ± 10 (range 0 to 44) and were significantly different between survivors (11±8) and patients who died (24 ± 10) ($P < 0.001$).

The average duration of hospitalization for surviving patients was 30 ± 30 days (range, five to 180 days). The average day of death for patients who died was 30 ± 35 days (range, two to 159 days). The average number of days in the ICU was 8 ± 14; of antibiotic administration, 12 ± 8; with fever (temperature $\geq$ 37.6°C), 11 ± 13; with leukocytosis (WBC count $\geq$ 10,000/cu mm), 11 ± 14; and with APS greater than 10, 4 ± 7. Ninety-eight (52%) of the patients spent some time in the ICU.

Escherichia coli and Bacteroides fragilis groups were the two most common isolates of 94 separate species. The kinds and numbers of bacteria recovered and the numbers of blood cultures obtained or shown to be positive were not substantially different in survivors and patients, who died.

A criticism of the SIS system proposed, herein, as well as the other systems discussed, is the lack of long-term health evaluation, an assessment of the patient's overall state of health prior to the acute event being assessed.

Prognostic criteria in Intra-Abdominal Sepsis : (Kalfarentjos et al, Int. Surg 87.72, 1985-187)

Forty-two patients with proven intra-abdominal sepsis were studied in a prospective clinical trial.

The following parameters were evaluated :

(1) Nine parameters on admission were noted - age, sex, obesity, malnutrition, history of cardiac, respiratory or renal disease, diabetes mellitus and malignant neoplasia. Four of these parameters (age 65 years, diabetes mellitus and cardiac disease) were prognostically significant ($P < 0.05$).

(2) Thirty parameters representing the functional status of six organic systems during sepsis - respiratory, cardiovascular, nervous, kidneys, blood coagulation, liver, were also analysed. Six of these parameters had a prognostic value : DEEP 0-10 cm H_2O to keep PaO_2 $\geq$ 60 mmHg ($P \leq 0.001$), serum creatinine $\geq$ 3.6 mg/dl ($P \leq 0.01$), prothrombine time $\geq$ 15 minute or platelet count $\leq 100,000/mm^3$ ($P \leq 0.01$) and mental confusion. The combination of these ten statistically significant prognostic criteria for each patient showed that the mortality was 0 with 0-2 criteria, 36% with 3-5 criteria, 94% with 6-8 criteria and 100% with 8-10 criteria. Patients with more than five of these criteria had a significant higher mortality risk ($p < 0.001$).

THE PERITONITIS INDEX ALTONA (PIA II) :

This system was developed at Altona General hospital. As with MPI, the PIA system is based on anaemnastically derived data, intra-operative findings and physiologic information : PIA II, the refined version of the original index yields a more precise definition of patient population.

In the development of PIA II, all 567 patients operated between 1978 were included. The definition of intra-abdominal infection did not include cholecystitis and appendicitis without perforation. First the variable rendered were evaluated with respect to their influence of target variable survivor or non-survivor,utilizing the Yates corrected chi suqre test. For this purpose qualitative variables were transformed into quantitative data. Since the aim was to develop an index describing the prognosis of patients before any specific therapy was initiated, only information available pre and intra operatively was used. During the selection of criteria, only those risk factors that were sufficiently frequent, clearly defined, simply evaluated and reproducible were utilized. Therefore, the list obtained from chronic health evaluation was considerably reduced. Insulin dependent

diabetes mellitus, a well defined variable, proved to be an important risk factor. It was not possible, to omit the highly predictive variable of congestive heart failure. Also aspects of etiology and origin of infection as well defined variables as assessed at primary operation were utilized. Only two laboratory findings leucocyte count and serum creatinine were accepted by discriminant analysis. They could be affected only moderately by initial therapy. The patient population was then randomly assigned to a test group (60% of all patients) or to a validation group 40% of all patients. In the test group cross tabulations with the outcome of peritonitis was performed for combination of variables including disease origin and etiology, and the relative mortality was noted. Those groups with mortality risk most deviant from the average were listed and subjected to multivatiate discriminant analysis. With this method, the index for an individual patient was calculated according to :

$$C = c(1)V(1) + c(2)V(2) + ... + c(n)V(n) + K$$

Where C = Index, $c(1).....c(n)$ = coefficients (weighing factors), V = value of the variable and K = constant.

The last step was to validate the score calculated on the remaining 40% of patients not used to calculate the score.

Stepwise discriminant analysis ranked the entrance variables according to their power in discriminating between the target variables and attributing a discrimination factor to each. These factors were transformed to ease clinical applicability into a score with zero as a midpoint. Negative values predicted an increased likelihood of death, positive values an increased probability of survival. The confidence limits were 97.5% correct prediction at scores below -1.315 and above +1.315 and 68.5% at scores below -0.275 and above +0.275 respectively. In the patients studied the scores ranged between -7.6 and 2.7. The MA II score classified 89% of all test group patients correctly. The validation of the score in the unknown patient group correctly classified 81.4% of cases. Additionally an equation was developed to calculate an individual's mortality risk from the score.

$$PX = \frac{e^{2.8\ (PIAX)}}{1 + e^{2.8\ (PIAX)}}$$

were P_x = probability of survival or death and PIAX = individual score of patient. The mean of all P_x's of a patient population may then be used to evaluate results of a new treatment modality (Wittmann et al 1987).

E.H. Elbute and H.S. Stoner (1983) proposed a simple system of grading for intra-abdominal sepsis. A comprehensive list of the clinical features of the septic state was drawn up from which four classes of atribute were chosen for grading which would describe the severity of sepsis adequately and about which accurate information is usually available at the district hospital level. The chosen classes were the local effects of sepsis, pyrexia, secondary effects of sepsis and laboratory date. Each atribute was then placed on visual linear scale, one end corresponding to sepsis, the other to very severe sepsis. A numerical scale with 0,1,2 and 3 marked on it at equal intervals was superproposed on the analysing scale and the score nearest the mark for the atribute was chosen for sepsis grading scheme.

After typing the system on a few patients, it become obvious that the scoring of the local effects of tissue infection should be a major determinant of the aggregate score and in order to reflect this the weighing of these atributes was increased to give a scale with 0,1,2,4, and 6 as the possible scores.

TABLE - 1

SCORING OF LOCAL EFFECTS OF TISSUE INFECTION

Attribute	Score
Wound infection with purulent discharge/ enterocutaneous fistula	
Requiring only light dressing changed not more than once daily	2
Requiring to be dressed with a pack, dressing needing to be changed more than once daily, requiring application of a bag and/or requiring suction	4
Peritonitis	
Localized peritonitis	2
Generalized peritonitis	6
Chest infection	
Clinical or radiological signs of chest infection without productive cough	2
Clinical or radiological signs of chest infection with a cough producing purulent sputum	4
Full clinical manifestrations of lobar/ bronchpneumonia	6
Deep-seated infection (e.g. subphrenic abscess, pelvic abscess, empyema thoracis, acute or chronic osteomylitis)	6

TABLE - II

SCORING OF PYREXIA (ORAL TEMPERATURE)

Attribute	Score
Maximum daily temperature (C.)	
36 - 37.4	0
37.5 - 38.4	1
38.5 - 39	2
⌐39	3
⌊36	3
	Add
Minimum daily temperature ⌐37.5 C	1
If 2 or more temperature peaks above 38.4°C in 1 day	1
If any rigours occur in a day	1

Temperature should be recorded at least 4 times in 24 hrs. The record for the 24 hrs. period is assessed as above and 'pyrexia score' computed.

TABLE - III

SCORING OF SECONDARY EFFECTS OF SEPSIS

Attribute	Score
Obvious jaundice (in the absence of established hepatobiliary disease)	2
Metabolic acidosis	
Compensated	1
Uncompensated	2
Renal failure	3
Gross disturbance of mental orientation/ level of consciousness (e.g. delirium, coma) and/or other focal neurological manifestations of pyaemia/septicaemia (having excluded other causes)	3
Bleeding diathesis (from disseminated intravascular coagulation)	3

TABLE - IV

SCORING OF LABORATORY DATA

Attribute	Score
Blood culture	
Single positive culture	1
Two or more positive cultures separated by 24 h	3
Single positive culture + history of invasive procedure	3
Single positive culture + cardiac murmur and/or tender enlarged spleen	3
Leucocyte count ($x10^9/l$)	
12 - 30	1
$\nearrow$30	2
$\swarrow$2.5	3
Haemoglobin level in the absence of obvious bleeding (g/d)	
7 - 10	1
$\swarrow$7	2
Platelet count ($x\ 10^9/l$)	
100 - 150	1
$\swarrow$100	2
Plasma albumin level (g/l)	
31 - 35	1
25 - 30	2
$\swarrow$25	3
Plasma total bilirubin level in the absence of clinically obvious jaundice	
$\nearrow$25 pmol/l	1

This grading system has been applied to 15 patients. Five of these patients died and in 4 of them the highest score exceeded 20, whereas in the patients who survived the score only rose above 20 in one. This system differs from the injury severity score in that it tells you the severity of sepsis at a particular time whereas a patient's injury severity score remains same throughout his course. The sepsis score thus can be used to follow the progress of a patient.

A. Billing, D. Frholich et al in 1994 assessed the reliability of Mannheim peritonitis index and its predictive power for different populations examined in a study of 2003 patients from seven centres in three European countries. The prevalence of risk factors varied considerably between the groups. For a threshold index score of 26, the sensitivity was 89 (range 54-98) percent, specificity 74 (range 58-97) percent and accuracy 83 (range 70-94) percent in predicting death. For patients with a score less than 21 the mean mortality rate was 2.3 (range 0-11) percent, for score 21-29 22.5 (range 10.6-50) percent and for score greater than 2959.1 (range 41-87) percent. The mean index score and mean mortality rate correlated in the different groups, reflecting a homogeneous standard of therapy for peritonitis.

The Mannheim peritonitis index provides an easy and reliable means of risk evaluation and classification for patients with peritoneal inflammation.

Both the Mannheim peritonitis index and APACHE II score predict outcome of and classify, peritonitis but the former is superior.

AIMS OF PRESENT STUDY

AIMS OF PRESENT STUDY

- To study the prognostic factors for peritonitis utilizing, Mannheim peritonitis index and other grading systems.

- To study various other risk factors related to peritonitis.

- To assess the efficacy of Mannheim peritonitis index in predicting the prognosis of pertitonitis due to any cause and compare it with other grading systems.

MATERIAL AND METHODS

MATERIAL AND METHODS

In the present study 121 patients admitted in Surgery Department of M.L.B. Medical College, Hospital, Jhansi between January 1995 to January 1996 have been considered.

All these patients had peritonitis causes ranging from :

1. Perforation :
   - Stomach and duodenum
   - Appendix
   - Colon
   - Small Bowel
   - Genitourinary (Post D and C)

2. Abscesses :
   - Burst liver abscess
   - Pyoperitoneum

3. Haemoperitoneum :
   - Mesentric tear
   - Pancreatitis
   - Vascular injury

Note : Patients with paediatric age (0-36 months) group and patients with post operative peritonitis and of abstruction were not considered in the present study.

For Mannheim Index Information is collected during the first laparotomy, enabling immediate classification.

And for severity of sepsis score, the patients keep in record even in post-operative days.

Following is the working proforma for prediction of mortality and morbidity.

WORKING PROFORMA

Peritonities Index

TOPIC : THE MANNHEIM PERITONITIS INDEX AND OTHER GRADING SYSTEMS IN THE EVALUATION OF PERITONEAL SEPSIS.

CASE NO. CONSULTANT

NAME: M.R.D. NO. :

AGE/SEX : WARD/BED :

ADDRESS : D.O.A. :

D.O.D. :

Diagnosis :

Clinical Presentation

-	Age ⩾ 50 years	5
-	Sex, if female	5
-	If profuse generalized peritrionities if ⩾24 hours	4
-	Origin of sepsis, not colonic	4
-	Malignancy, if present	4
-	Type of exudate - Clear	0
	- Cloudy or purulent	6
	- Fecal	12

Organ failure 7

a. Blood - Serum creatinine
- Urea

b. Plain X-ray abdomen

c. Mode of surgery

d. Lung - Po_2

- PCo_2

e. Urine output

f. Shock if present

g. Intestinal Obstruction (only if profound Paralysis — 24 hrs. or complete mechanical ileam.

GRAND SCORE _____

_____

OBSERVED SCORE _____

_____

GRADING OF SEPSIS

Clinical presentation	Score
- Wound infection with purulent discharge/ enterocutaneous fistula	
a. Requiring only light dressing changed not more than once daily	2
b. Requiring to be dressed with a pack dressing needing to be changed more than once daily, requiring application of a bag and/or suction	4

- Peritonitis

  a. Localized peritonitis 2

  b. Generalized peritonitis 6

- Chest infection

  a. Clinical or Radiological signs of chest infection without productive cough 2

  b. Clinical or Radiological signs of chest infection with a cough producing purulent sputum 4

  c. Full clinical manifestation of lobar/bronchpneumonia 6

- Deep seated infection (e.g. subphrenic abscess) Pelvic abscess, empyema thoracis, Osteomylitis) 6

- Oral temperature charting

  36 - 37.4°C 0

  37.5 - 38.4°C 1

  38.5 - 39°C 2

  ⩾39°C 3

  ⩽36°C 3

  6 a.m. 12 a.m. 6 p.m. 12 p.m.

  Minimum daily temperature if ⩾37.5°C 1

- If 2 or more temperature peaks above

  38.4°C in one day 1

- If any rigors occur in a day 1

- Obvious jaundice (with absence of established hepatobiliary disease) 2

- Metabolic Acidosis
  - Compensated 1
  - Uncompensated 2
- Renal failure if present 3
- Gross disturbance of Mental orientation/ level of conciousness (e.g. delirium, coma) and/or other focal neurological manifestation of pyraxia/manifestation of pyraxia/ Septicemia (having excluded other causes) 3
- Bleeding diathesis if present 3
- Single positive culture 1
- Two or more positive cultures separated by 24 hrs. 3
- Single positive culture + History of invasive procedure 3
- Single positive culture + cardiac murmur and/ or tender enlarge spleen 3
- TLC ($X\ 10^9/L$)
  - 12 - 30 1
  - $\overline{7}30$ 2
  - $\angle 2.5$ 3
- Haemoglobin level (gm/dl)
  - 7 - 10 1
  - 10 2
- Platelet count ($X\ 10^9/l$)
  - 100 - 150 1
  - $\angle 100$ 2

- Plasma albumin (gm/lit)

7 31 - 35	1
25 - 30	2
∠25	3

Total bilirubin level if

7 25 umol/Lit.	1

GRAND SCORE _____

OBSERVED SCORE _____

OBSERVATION

OBSERVATION

The present prospective study consists of 121 cases of peritoneal sepsis admitted in Emergency department of M.L.B. Medical College, Hospital, Jhansi. All these patients were admitted from January 1995 to January, 1996.

Table I shows that maximum number of patients were encountered in 26-50 years age group (62.88%) followed by 30 patients (24.79%) from 51-75 years of age group. Lowest age was 4 years and highest was 72 years.
Note : Infants were not considered in the present study.

Table II shows males (63.63%) out numbered females (36.36%).

Table III shows that small intestine excluding duodenum was the most frequent site to be affected (47.10%) followed by Gastric and Duodenal perforation (22.30%), and only 6 patients (4.95%) had colonic perforation.

Table IV shows that 30 patients (24.79%) developed peritoneal sepsis because of traumatic perforation of Intestine followed by Duodenal ulcer perforation in 27 patients (22.31%) and only 2 patients (1.65%) had tubercular perforation, peritoneal sepsis because of enteric perforation was seen in 15 patients (12.39%).

Table V shows that maximum number of patients 76 (73.78%) stayed in the hospital for 10-20 days, followed by 16 patients (15.33%) who stayed for 21-30 day and only 11 patients (10.67%) stayed for more than 31 days. 76 patients who stayed for 10-20 days had a mean MPI score of 22.5 (13-39) and a mean 'SS' score of 11.8 (3-17), 16 patients had a mean MPI score of 30.9 (21-43) and a mean 'SS' score of 18.5 (12-22) and the patients who stayed for ⁻/31 days had a mean MPI score of 22.5 (13-39) and a mean 'SS' score of 11.8 (3-17). And 4 patients out of 103 patients left against medical advise (LAMA).

Table VI shows that (14.87%) cases expired who had a mean MPI (Mannheim Peritonitis Index) score of 32.16 (range 23-38) and severity of sepsis score (SS) 25 (range 15-42) in comparison to those who survived (85.12%) MPI score 25.6 (range 13-43) and (SS' score 14.05 (range 3-39).

Table VII shows that 31 patients out of 121 cases developed disease related abdominal complication and among these stitch line infection/wound dehiscence a minor complication in 12 patients (38.70%) was on the top of

the list with a mean MPI score of 25 (range 14-38) and mean 'SS' score of 16.5 (range 12-22) followed by seroma collection in 8 patients (25.8%) who had a mean MPI score of 24 (14-33) and mean 'SS' score of 15.5 (13-18). 11 patients developed major complication, 6 of them developed faecal fistula (19.35%) 1 who had a mean MPI score of 23.3 (25-38) and a mean 'SS' score of 22.3 (19-39), 5 patients (16.12%) developed pelvic abscess who had a mean MPI score of 32 (27-37) and a mean 'SS' score of 20.4 (17-28). 72 patients (69.90 developed no complication, they had a mean MPI score of 25.2 (13-32) and a mean 'SS' score of 12.3 (3-14).

TABLE - I

AGE DISTRIBUTION OF CASES

Age group (years)	Number of patients (121)	Percentage
0 - 25	15	12.39
26 - 50	76	62.88
51 - 75	30	24.79

TABLE - II

SEX DISTRIBUTION OF CASES

Sex	Number of patients (121)	Percentage
Male	77	63.63
Female	44	36.36

TABLE - III

DISTRIBUTION OF CASES ACCORDING TO ANATOMICAL SITE

Anatomical site	Number of patients (121)	Percentage
Gastric and duodenal	27	22.30
Jejunal and Ileal	57	47.10
Appendicular	20	16.52
Colonic	6	4.95
Others (Splenic, Liver Peritoneal, Pancreas Mesentry)	11	9.09

TABLE - IV

DISTRIBUTION OF CASES ACCORDING TO CAUSE OF PERITONEAL SEPSIS

Cause	Number of patients (121)	Percentage
Perforated Gastrics Duodenal Ulcer	27	22.31
Appendicular	20	16.52
Traumatic perforation of intestine	30	24.79
Enteric perforation	15	12.39
Tubercular perforation	2	1.65
Ischaemic Jejunitis and perforation	10	8.26
Colonic perforation	6	4.96
Others (Splenic, Mesentric, Peritoneal)	11	9.09

TABLE - V

DISTRIBUTION OF DURATION OF STAY RELATED TO MEAN SCORE OF INDICES

Period of Hospitalization	Number of cases (103)	Mean MPI score Max-47	Mean SS score Max-55
10 - 20	76 (73.78%)	22.5 R(13-39)	11.8 (3-17)
21 - 30	16 (15.33%)	30.9 R(21-43)	18.5 (12-22)
7 31	11 (10.67%)	28.3 R(24-38)	22.5 (19-29)

R = Range

TABLE - VI

DISTRIBUTION OF MEAN SCORE IN EXPIRED AND SURVIVING CASES

Result	Number of patients (121)	Mean MPI (Max-47)	Mean SS (Max-55)
Expired	18 (14.87%)	32.16 R (23-38)	25 (15-42)
Survived	103 (85.12%)	25.6 R (13-43)	14.05 (3-39)

R = Range

TABLE - VII

DISTRIBUTION OF DISEASE RELATED ABDOMINAL COMPLICATION TC MEAN SCORE OF INDICES

Post-operative follow up	Number of patients & percentage (103)	Mean 'MPI (Max-47)	Mean 'SS' (Max-55)
No complication	72 (69.90%)	25.2 R (13-32)	12.3 (3-14)
Minor complication	20 (19.40%)	24.60 R (14-38)	16.2 (12-22)
(a) Seroma collection	8 (25.8%)	24 R (14-33)	15.5 (13-18)
(b) Stitch line infection/wound dehiscence	12 (38.7%)	25 R (14-38)	16.5 (12-22)
Major complication	11 (10.67%)	32.1 R (25-38)	21.4 (17-39)
(a) Faecal fistula	6 (19.35%)	32.3 R (25-38)	22.3 (19-39)
(b) Pelvic abscess	5 (16.12%)	32 R (27-37)	20.4 (17-28)

R = Range

DISCUSSION

DISCUSSION

The present study was conducted at M.L.B. Medical College, Jhansi during the period of January 1995 to January 1996. In this study 121 patients of Peritoneal Sepsis, majority of whom had gastro-intestinal perforation, were included.

Intra abdominal infections have always formed a sizeable fraction in patients admitted to any surgical emergency. Intra abdominal sepsis in addition to being the major cause of mortality in surgical ward is also a cofactor for the morbidity in another sizeable fraction. The attention demanded by peritoneal sepsis in a surgical setup can not be overemphasized.

For proper resource allocation and to know the prognostic and risk factors, a grading of severity of intra abdominal infection according to certain physiological and biochemical criteria has been needed for a long time. The various indices and scoring systems specially "The Mannheim Peritonitis Index" and"Severity of Sepsis" score have apparently moved in to fill the void.

In this present study an attempt was made to assess the efficacy of "Mannheim Peritonitis Index" and

"Severity of Sepsis" in predicting the eventual outcome of peritoneal sepsis patients in general, in set up like ours.

We found the maximum incidence (62.88%) of peritoneal sepsis in the age group between 25-50 years followed by 51-75 years (24.79%) age group and was minimum in 0-25 year age group (Table 1). The youngest patient was 4 years old (12.39%) and the oldest was 70 years. The incidence compared well with that of Delinger et al (1985), De Bakey (1940) 30-50 years, Mishra (1981) 31-60 years, Elebute EA and Stoner HB 45 $\pm$ 15 years (1983), and 60.3% Surendra (1994).

Male (63.63%) out numbered female (36.36%) (Table - II). This was probably because of the habit of chronic smoking in males making them more susceptible for duodenal perforation and also being the main broad earner of the family, males have to do more outdoor activity and thus makes them more prone for traumatic injury leading to peritoneal sepsis. In the present study traumatic perforation was the main cause of peritoneal sepsis and in this group 80-90% sufferers were males.

The small intestine, excluding duodenum, was the most frequent site involved seen in 57 patients (47.10%) followed by gastric and duodenum in 27 patients (22.30%), Appendix as the originator of peritoneal sepsis was 3rd in the list in 20 patients (16.52%). This is in contrast to studies of Wittman DH (1987) in which perforation in stomach and duodenum formed 30% of cases followed by appendix 22%, large bowel in 21% and small bowel only in 13%. This difference is perhaps due to a higher incidence of traumatic perforation and widespread prevalence of bidi smoking in our society and the almost non existent immunization for typhoid in the general population. But our results were comparable to Surendra (1994) small bowel 50%, followed by duodenum (24.5%), appendix (12.3%), large bowel (4.7%). Similarly Bhansali (1967) found small bowel perforation in 44.7% patients and 40% by Roa (1988).

Traumatic perforation leading to peritoneal sepsis was the main cause in our study, seen in 30 patients (24.79%) followed by duodenal and gastric ulcer perforation in 27 patients (22.31%), appendix in 20 patients (16.52%), enteric perforation in 15 patients (12.39%). Minimum patients were of tubercular perforation 2 (1.65%) (Table IV).

This incidence of etiological factor is comparable to the studies of Surendra (1994) in which traumatic perforation was seen in 26.5%, followed by duodenal ulcer perforation in 23.6%. Ischaemic perforation in 8.4% and tubercular perforation in 1.2% of patients. But lately blunt and pnetrating abdominal trauma was becoming increasingly common both as a result of population explosion as well as increase in the number of vehicles on road and weapons in society. Among the etiological considerations of peptic ulcer perforations, we must keep in mind that increasingly longevity with associated disease in an aging population has meant consumption of drugs with known ulcerogenic potential like aspirin, indomethacin, corticosteroids and phenylbutazone etc. (Jorgensen 1977 & Bhattacharya 1980), all of which can ultimately cause perforation.

The maximum number of patients, 76 (73.78%) stayed in hospital for 10-20 days followed by 16 (15.33%) patients who stayed for 21-30 days and only 11 (10.67%) patients stayed for more than 31 days and 4 patients out of 103 patients left Against Medical Advise (LAMA). Among these, one was from group who stayed for 21-30 days and 3 were from who stayed for more than 31 days. Thus the patients who stayed for 10-20 days, had a mean MPI score of 20.5 (range 13-39)and mean 'SS' score of 11.8 (range 3-17).

And patients who stayed for 21-30 days had a mean MPI of 30.9 (range 21-43) and mean 'SS' score of 18.5 (range 12-22) and those staying for more than 31 days had a mean MPI score of 28.3 (range 24-38) and 'SS' score of 22.5 (range 19-29).

MPI score as it is being taken at the time of laparotomy, does not change during postoperative period but the 'SS' score may increase or decrease in the post-operative period according to the condition of the patient. Thus the patients who stayed for $\overline{>}$ 31 days had a mean 'SS' score of 22.5 (range 19-29) in comparison to those who stayed for 21-30 days had a score of 18.5 (12-22) and 11.6 (3-17) for those who stayed for 10-20 days.

There was a significant change in 'SS' score in relation to the period of hospitalization, hence we believe that the 'SS' score was better for predicting the morbidity of patients in postoperative period. Patients with low score in both the indices showed better outcome of the post-operative period.

Coming to the mortality it was seen that 18 patients (14.87%) who expired had a mean 'MPI' score of 32.16 (range 23-38) and a mean 'SS' score of 25 (15-42), while those who survived had mean MPI score of 25.6 (13-43) and

a mean 'SS' score of 14.05 (3-39). Thus, there is a apparent significant difference in the mean MPI score of patients who survived when compared to those who succumbed to septicemia. But the MPI score should not be the sole indicator of prediction of the outcome because with a scoring of 43 of MPI, survived and patients with 23 MPI score, expired. The results are comparable to A. Billing and D. Frohlich (1993) with a mortality of 13.4%, in a study of 887 patients. We also concluded that the patients who had a score more than 26 of MPI should be kept in ICU for better and prompt management.

31 patients (30.1%) developed disease related abdominal complication after laparotomy. Amongst these 20 patients (19.14%) developed minor complications and 11 patients (10.67%) developed major complications, 72 patients (69.90%) had no disease related complication in their post operative period (Table VII). This is comparable to that of Delinger et al (1985) study, whose 104 patients (72.72%) out of 143 survivors recovered following the index operation without any complication requiring any additional operative procedures and in 27.28% patients he found similar complication.

Among all 121 patients, the primary cause of infection was treated during index operation by closure of perforation, Resection and anastomosis with or without stoma formation, diversion of the intestinal tract Appendectomy and by splenectomy in traumatic peritonitis Similar operation were carried out in study of Surendra (1994) and V. Khanna (1995) in cases of peritonitis.

Lack of adequate laboratory support (facilities for performing serum electrolyte, arterial PH and blood gases) in our hospital has resulted in the late detection of subtile and unexpected biochemical derrangements, so that their timely prevention and precise correction was not always possible causing still higher mortality and morbidity. Similar lack of laboratory support to detect change in important biochemical parameters were noticed by Surendra (1994) in Jhansi and V. Khanna (1995) in Lucknow.

E. Coli was the most frequent bacteriological agent followed by Klebsiella sps and streptococcus sps in the patients who developed complication in postoperative period. This was comparable to the studies done by Surendra in department of Surgery, M.L.B. Medical College, Jhansi (1994) and Vishal Khanna in K.G. Medical College, Lucknow (1995).

Respiratory complications were the commonest amongst the other systemic complications. All the patients of duodenal perforation, spleenic injury and liver tear developed chest complications from the very 1st day of admission. This was comparable to the studies done by Dr. Surendra in department of Surgery, M.L.B. Medical College, Jhansi (1994) and Dr. Vishal Khanna in K.G. Medical College, Lucknow (1995).

We have observed that certain factors (secondary variables) in addition to a particular patient's 'MPI' and 'SS' scores also affects the outcome. Similar secondary variables were noticed in the studies done by Khanna V (1995). These factors are -

a) Duration of symptoms (primary and secondary delay), also quality of pre-admission treatment.

b) Tertiary delay

c) Nature, number and duration of surgical procedure

d) Antibiotics used

e) The quantity and quality of parenteral nutrition offered, if any

f) Blood transfusion requirement and its fulfilment

g) Early mobilisation

h) Availability of adequate : Respiratory support : O_2 therapy and ventilator support.

i) Nutritional status i.e. obesity or underweight

j) Presence of diabetes mellitus

k) Presence of advanced malignancy.

l) Presence of other systemic injury in case of traumatic perforation.

All these factors seem to play an important role in deciding the outcome by eventually affecting the both indices scores attained by any patient.

In our setup, most of the patients presented late (primary and secondary delay) with increased mean duration of symptoms.

However, there was also a tertiary delay on our part in operating the patients due to :

a) Limited operation theatre facilities

b) Scarcity of anaesthetists

c) Multiplicity of patients and other unavoidable causes.

Total parenteral nutrition in our set up is a luxury that most of the patients can not afford. Adequate supply of donated blood, fresh frozen plasma, clotting factor concentrates are not available to the patients thus,

resulting in a very high mortality due to haematological derrangements. This is in marked contrast to the western set up.

We do not have adequate facilities for oxygen therapy and ventilator support resulting in a very high mortality in patients from ARDS before adequate arrangements can be made for their transfer into units provided with these facilities.

These results are comparable to Elebute EA, Stoner HB (1981). The grading of sepsis trans WA & APACHE : A physiologically based classification system (1981) and Billing D Frohlich (1993).

At the end of the study we can conclude that all the patients who had a mean MPI score of more than 26 should be kept in ICU preferably for better and prompt treatment.

And all the patients who had a 'SS' score of 20 or more had more chances of developing morbidity.

And all the patients with high score of both indices should receive prompt and best treatment, so that these patients can be saved from morbidity and mortality.

CONCLUSION

CONCLUSION

121 patients admitted to M.L.B. Medical College, Hospital, Jhansi between January, 1995 to January, 1996 were considered in this present study. All these patients had peritonitis. The conclusions drawn in this study are as follow -

1. Although patients with peritoneal sepsis can be encountered at any age, but patients in 26-50 year age group have the maximum chance of suffering from peritoneal sepsis. The mean age for patients in this study was 35.6 years.

2. Total number of male patients with peritoneal sepsis in the present study were 77 (63.63%) as compared to 44 females (36.36%).

3. Small intestinal perforation leading to peritoneal sepsis was the most frequent cause of disease 57 (47.1%) followed by gastric and duodenal perforation 27 (22.30%). The peritoneal sepsis in the present study was most commonly due to peritonitis, subsequent to a perforation..

4. Traumatic perforation was amongst the most frequent (24.79%) cause of peritonitis followed by duodenal ulcer perforation (22.31%)

5. The maximum number of patients 76 (73.78%) stayed for 10-20 days followed by 16 (15.33%) who stayed for 21-30 days and only 11 (10.67%) patients who stayed for more than 31 days. This period of hospitalization is significantly related to the mean score of both the indices.

6. Mortality encountered in the present study was 14.87%, much lower than that reported by Delinger et al. All the patients who had expired had a mean MPI score of 32.16 (23-38) and mean 'SS' score of 25 (15-42), while the surviving group had a mean MPI score of 25.6 (13-43) and a mean 'SS' score was of 14.05 (3-39).

7. Stitch line infection or wound dehiscence was the most frequent 12 (38.7%) disease related abdominal complication. These patients had a mean MPI score of 25 (14-38) and mean SS score of 16.5 (12-22). Seroma collection occurred in 8 (25.8%) patients, these had a mean MPI score of 24 (14-33) and mean SS score of 15.5 (13-18). 11 patients who had a mean MPI score of 32.1 (25-38) and mean SS score 21.4 (17-39) developed a major complication like faecal fistula and pelvic abscess (Table VII). This shows that morbidity

of the patients is significantly related to the score of the indices. Similar reasults were obtained by Surendra (1994) and Khanna (1995).

The present study shows that these indices are good for predicting the outcome of patients and so in deciding the management accordingly. Indices scores also tell us about, which patient's should be kept in ICU, so that they can be offered the best that the surgical team can provide. This, however, does not mean that we should neglect those patients who have a low score, because every postoperative patient has a risk of mortality.

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SUMMARY

SUMMARY

A prospective study of 121 cases of peritoneal sepsis was conducted during the period from January 1995 to January 1996 at M.L.B. Medical College, Hospital, Jhansi, India.

For proper resource allocation and to know other factors affecting the outcome of patients, a grading of severity of peritoneal sepsis has been desired for a long time. The various scoring systems specially the MPI (Mannheim Peritonitis Index) and (Severity of Sepsis (SS) score have apparently moved in to fill the void.

Children below 36 months and patients of post-operative anastomotic dehiscence were not included in this study.

For MPI score, scoring was done peroperatively and 'SS' scoring continuied even in post operative period.

Analysis of the following were made using both the indices.

1. Sex
2. Age
3. Type of peritonitis
4. Duration of symptoms

5. Product of laparotomy

6. Temperature

7. Hb

- White blood count
- Pus culture
- Blood Urea and Sugar
- Serum creatinine & Bilirubin.

The present study showed that mean age of patient was 36.5 years and male population was affected in 63.63% cases. The youngest patient was a girl of 4 years and the oldest was a female of 72 years, 53% patients presented in the hospital between 30-50 hours after the perforation.

As regards the site, small bowel was most commonly involved followed by gastric and duodenal perforation.

Trauma was the most common cause of G.I. perforations in 24.5% followed by ulcer disease. Tubercular perforations were seen in only 2 patients.

Maximum number of patients (76) stayed for 10-20 days..Overall mean duration of stay was 14 days, and patients who stayed for 10-20 days had a mean MPI score of 22.5 and mean 'SS' score of 11.8 as compared to mean MPI of 28.3 and mean 'SS' score of 22.5 in patients staying for 7 31 days.

Morbidity and mortality was highest in enteric perforation and lung infection was commonest in ulcer perforation.

In present study, 18 (14.87%) patients expired with a mean MPI score of 32.16 (23-38) and a mean SS score of 25 (15-42) as compared to those who survived 103 (85.12%) had a mean MPI score of 25.2 (8-43) and a mean SS score of 12.3 (3-29). This low mortality may be because of traumatic peritonitis, where the patient recovers well as compared to pathological perforation. Most of the patient expired because of multiple organ failure.

Only 31 (30.1%) patients developed disease related abdominal complications and 20 out of these developed minor complications and 11 developed major complications like faecal fistula and pelvic abscess. Post operative morbidity was highest because of fistula.

Uneventful recovery occurred in 72 (69.9%) patients who were discharged on 10th to 14th post operative days.

The mannheim peritonitis index is a well validated peritonitis specific index but further increase of its prognostic power is desirable.

The sepsis severity score can thus be used to follow the progress of a patient.

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